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SKULL CHARACTERS OF *TELEORHINUS BROWNI* OSBORN[1]

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Introductory Remarks.—In 1903, several elongated crocodilian skulls and jaws, with some limb bones and vertebræ, were found by Mr. Barnum Brown in the region southeast of Pryor, Montana, and about thirty miles distant from that point. They occurred in Benton Shales of marine origin.

One of these skulls (Amer. Mus. No. 5851) was described by Osborn in 1904 as the type of *Teleorhinus browni*.[2] A considerable number of vertebræ and limb bones were associated with the skull.

The original generic description is as follows: "Cranium teleosauroid. Nasals continued forward to form roof border of anterior nares. Splenials prolonged into symphysis. Teeth compressed anteroposteriorly, uniformly grooved in front and behind." The portion of the specific description concerned with skull characters is as follows: "Forty maxillary and premaxillary teeth. Premaxillary teeth straight, maxillary teeth recurved.

"The skull (1000 mm.) and jaws (996 mm.) are preserved entire, with a larger number of the upper teeth. The skull in the upper view exhibits great breadth between the orbits, which are placed laterally. Large supratemporal fenestræ. Few sutures can be made out. The fronto-prefrontal elements connect anteriorly with the greatly elongated nasals which border the roof of the anterior nares."

In 1906, Williston discussed American amphicœlian crocodiles,[3] and compared *Teleorhinus browni* with "*Steneosaurus*" *geoffroyi*, *Pholidosaurus* von Meyer, *Teleidosaurus* Deslongchamps, and *Hyposaurus* Owen. In 1925, Troxell described the characters of *Hyposaurus* in detail, and discussed the relations of this genus.[4] Comparison of the characters of *Teleorhinus browni* with those of *Hyposaurus*, *Pelagosaurus* and *Teleidosaurus* clearly indicates generic distinction. The original description of *T. browni* by Osborn was brief and has never been followed

[1]Contributions to the Osteology, Affinities, and Distribution of the Crocodilia. No. 24.

[2]Osborn, H. F. 1904, '*Teleorhinus browni*—A Teleosaur in the Fort Benton,' Bull. Amer. Mus. Nat. Hist., XX, Art. 21, pp. 239–240.

[3]Williston, S. W. 1906, 'American Amphicœlian Crocodiles,' Journ. Geol., XIV, pp. 1–17, 12 figs.

[4]Troxell, Edward L. 1925. 'Hyposaurus, a Marine Crocodilian,' Amer. Journ. Sci., Ser. 5, IX, pp. 489–514, 15 figs.

by a full description. The skull has been studied by the writer in connection with the preparation of a memoir on the crocodilian order as a whole, and many of the details of structure have been made out. These details are brought together in the present form because of necessary delay in the appearance of the complete memoir.

SKULL PROPORTIONS.—The skull is exceedingly long and narrow. The snout, especially, is extremely long and slender. The length of the mid-line is over three times the breadth across the quadrates. The length of the snout along the mid-line is over four times its breadth at the base. The snout narrows rapidly from the base forward, and its sides converge forward only to a very slight extent throughout most of its length. The minimum breadth of the snout is immediately back of the posterior expansion; this minimum breadth is only one-sixteenth of the total length of the snout. The tip of the snout is somewhat expanded laterally, and is definitely turned downward. The cranial table is comparatively small.

SKULL OPENINGS.—The foramen magnum was evidently small, but its outlines cannot be made out accurately owing to crushing of the bony elements surrounding it. The supratemporal fenestræ are large, but not excessively so. They are approximately equal in length and breadth, and are subquadrate in outline. The lower temporal arch is absent on each side; consequently the outlines of the lateral temporal fenestræ cannot be made out. The orbits are relatively small, and face upward, outward, and forward. Even before crushing it is unlikely that they faced directly outward as in *Pelagosaurus*. They are widely separated from each other. The external narial aperture is comparatively broad; it is situated on the anterior expansion of the snout, and is broader than the entire snout at the level of its minimum breadth. The aperture is subcircular in outline; it is protected anteriorly and laterally by upturned flanges of the premaxillaries. The original description states that the nasals form the posterior borders of the aperture. This interpretation is not supported by the recent studies of this skull. The posterior border of the aperture appears to be composed of portions of the premaxillary bones.

On the palate there is no direct evidence of a small premaxillary foramen, but the region is incompletely preserved, and such a foramen may have been present. The palatine fenestræ are short antero-posteriorly. They extend forward past only four or five pairs of maxillary teeth. The posterior borders are incomplete, but broken edges of the pterygoids indicate that they probably did not extend very far back. The internal narial aperture and the bones surrounding it are not preserved.

SKULL BONES.—The sutures of the skull can be made out in only a few places; consequently a detailed description of each of the skull elements is impracticable. Some of the sutures can be made out, however, and other characters give clues to the identification of certain bones, so many of the bones may be described.

The nasals were stated in the original description to comprise part of the posterior border of the narial aperture. The adhering matrix has recently been cleaned from the anterior portion of the snout, and the relations of nasals and premaxillaries can now be made out with certainty. The posterior border of the narial aperture is composed of premaxillary bones and not of nasals. The nasals do, however, extend far forward and enter into contact with the premaxillaries.

The nasals are extremely long and slender. They extend forward to about the level of the sixth maxillary teeth. They extend forward along the mid-line for a distance slightly greater than two-thirds of the total length of the snout.

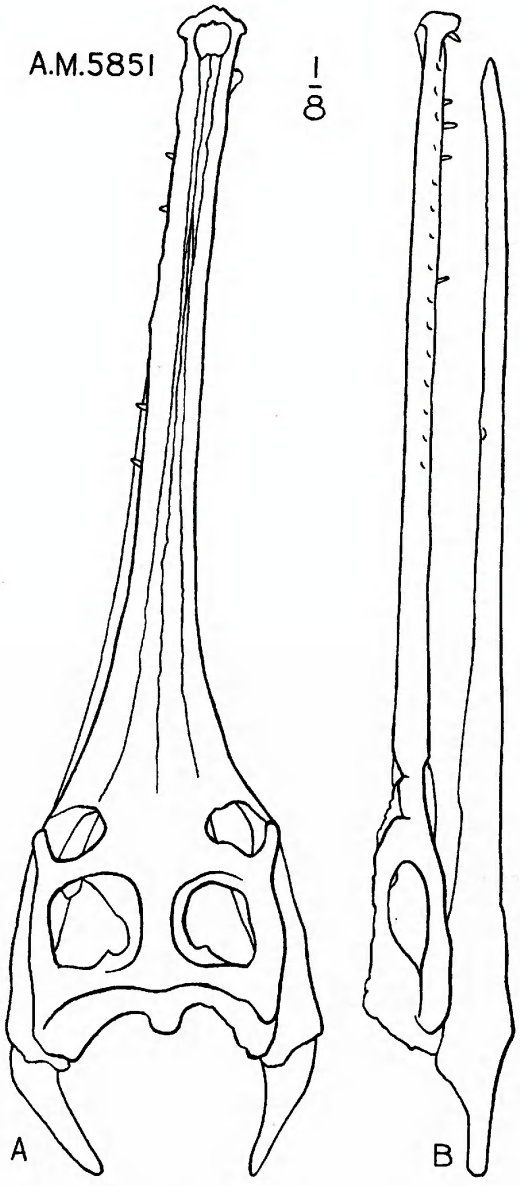

Fig. 1. *Teleorhinus browni* Osborn. Type specimen, skull and jaws (Amer. Mus. No. 5851). One-eighth natural size.

A, superior view; B, lateral view, left side.

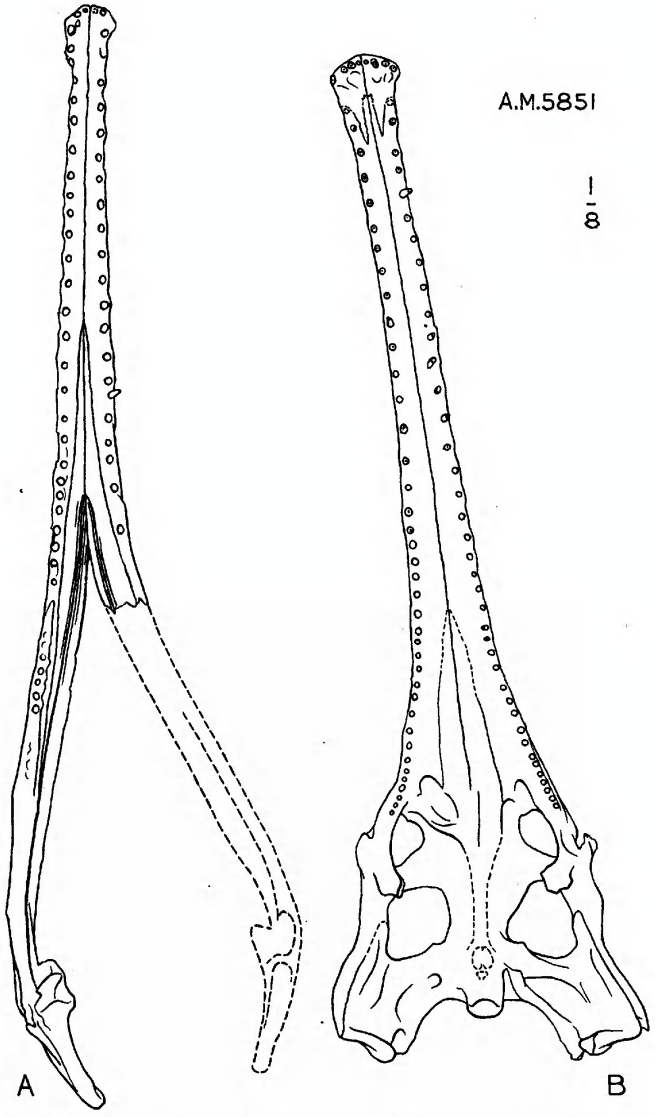

Fig. 2. *Teleorhinus browni* Osborn. Type specimen, skull and jaws (Amer. Mus. No. 5851). One-eighth natural size.

A, lower jaws, superior view; B, skull, inferior view.

The premaxillaries send back elongate posterior processes that overlap the nasals somewhat. They extend backward to a level midway between the seventh and eighth maxillary teeth. The overlap is about 33 millimeters in length, and for this distance the nasals are separated from the maxillaries by these processes of the premaxillaries. The premaxillaries surround the external narial aperture, and form the entire anterior expansion and downward projection of the snout.

On the palate the premaxillaries do not extend very far back, only to the level of the fourth maxillary teeth. The premaxillo-maxillary suture on the palate is simple in outline, the two premaxillaries forming a symmetrical wedge, with concave external borders, between the anterior ends of the maxillaries. Four alveoli are present in each maxillary. These are arranged in a slightly curved, but nearly transverse, row. The first three pairs depart very little from a direct transverse arrangement, but the fourth pair is slightly posterior and decidedly external to the others. The first, or median, alveoli are the smallest, the others are subequal in size.

Posterior to the second premaxillary teeth is a pair of deep pits which lodged mandibular teeth; a second pair of shallower pits lies external to the first pair, and a pair of external grooves is postero-external to these. There are no alveoli along the lateral borders of the premaxillaries; consequently there are diastemata between the premaxillary and the maxillary teeth.

Each maxillary appears to contain thirty-eight alveoli; it is possible that this number should be reduced to thirty-six, owing to the incompleteness of the alveolar borders at some points. The maxillary alveoli for the anterior three-fourths of the series are subequal in size, and are essentially equidistant from each other. The last eight or nine alveoli are smaller and closer together. All of the alveoli are complete in themselves, there being no suggestion of an alveolar groove. In the anterior portion of the series the distance from the center of one alveolus to the center of the next is equal to the height of a fully erupted tooth from base to tip. The alveoli indicate that the teeth were curved, and that they extended outward, forward and downward. Each alveolus is surrounded by a low crater-like wall, or rim.

The two maxillaries meet on the mid-line of the palate from the level of the fourth to the vicinity of the level of the twenty-second maxillary teeth. The anterior portions of the maxillo-palatine sutures are not distinctly preserved in the specimen, but they appear to meet at or near the level of the twenty-second maxillary teeth.

The region of the palatine and pterygoid bones is not well preserved in the specimen, making a clean-cut interpretation of this important region impossible. It is quite likely, however, that the internal narial aperture was situated rather far forward, perhaps between the posterior portions of the palatines.

MANDIBLE.—The mandible is long and slender. The symphysial and post-symphysial portions are about equal in length. The dentary bone occupies over two-thirds of the total length of each ramus. The jaw is extremely shallow vertically, and the tip is slightly expanded laterally. The symphysis extends back to about the level of the twenty-fourth mandibular teeth. The splenial comprises a considerable portion of the symphysis, extending forward to the level of the seventeenth mandibular teeth. The sides of the mandible are subparallel to the level of the seventeenth mandibular teeth; they then widen or diverge gradually to the level of the twenty-seventh teeth, just posterior to the symphysis. Back of this they diverge more rapidly.

The number of alveoli in each dentary is not clear, but appears to be thirty-eight. Each dentary has two small alveoli arranged transversely, at the tip, corresponding

in position with the three alveoli in the premaxillary. Posterior to these two alveoli, the alveoli are approximately equal in size and are arranged at approximately equal distances to the vicinity of the posterior end of the symphysis, back of which they are closer together and are smaller.

TEETH.—A few teeth are preserved. They are slender, subcircular in outline, and decidedly curved. They extend downward, forward, and a little outward in the upper jaws, and upward, forward, and a little outward in the lower jaws. They did not extend outward in the manner exhibited in many specimens of European teleosaurs. The teeth are striated longitudinally with rather fine striæ. None of the posterior teeth are preserved. The general adaptation implied by the form of the teeth is a fish-eating habit. The teeth, at least superficially, resemble those of many forms whose habits are known to be piscivorous.

CONCLUSIONS.—Although not closely related to *Teleosaurus*, *Steneosaurus*, or other typical Jurassic teleosaurians, *Teleorhinus browni* clearly has teleosauroid affinities. As pointed out by Troxell for *Hyposaurus*, it represents a survival of a primitive group, living along with the earlier forms of the procœlous crocodilians. In Europe, the teleosaurs definitely disappear before the procœlous forms appear on the scene. This survival involves a marine form, whose competitors were plesiosaurs and other marine reptiles, rather than river crocodilians.

MEASUREMENTS:—

Length of skull along mid-line	960 mm.
" " " including quadrates	1000
" " snout in front of orbits	750
Breadth across quadrates (restored)	310
" " posterior end of cranial table (restored)	242
" " orbits	242
" " posterior end of snout	177
" " tip of snout	67
" " snout, minimum	46
" " supratemporal fenestræ	192
" between supratemporal fenestræ	22
" " orbits	95
Length of longest tooth preserved, external to alveolus	24
" " external narial aperture	34
Breadth of external nares	48
Length of cranial table	120
" " mandible	1065
" " symphysis at surface	480
" " " entire	538
Breadth at symphysis	75
" minimum	37
" maximum (distorted)	300
Ratio, total breadth of skull over median length	323
Ratio, breadth of snout at base over length of snout	236